

$$\textcircled{1} 15$$

$$\textcircled{2} 3\sqrt{30}$$

$$\textcircled{3} 48\sqrt{2}$$

$$\textcircled{4} 40\sqrt{7}$$

$$\textcircled{5} 60\sqrt{3}$$

$$\textcircled{6} 6\sqrt{5}$$

$$\textcircled{7} 30\sqrt{2}$$

$$\textcircled{8} 60\sqrt{6}$$

$$\textcircled{9} 20$$

$$\textcircled{10} \frac{3\sqrt{2}}{7}$$

$$\textcircled{11} \frac{\sqrt{5}}{2}$$

$$\textcircled{13} \frac{\sqrt{30}}{w}$$

$$\textcircled{14} \frac{\sqrt{2}}{2}$$

$$\begin{array}{c} 30 \\ \swarrow \searrow \\ 3 \quad 10 \\ \quad \swarrow \searrow \\ \quad 2 \quad 5 \\ \sqrt{3 \cdot 2 \cdot 5} \end{array}$$

$$x + y =$$

$$\textcircled{15} \sqrt{4} + \sqrt{5}$$

$$\textcircled{16} 15\sqrt{3}$$

$$\textcircled{17} -7\sqrt{6}$$

$$\textcircled{18} 2\sqrt{3}$$

$$\textcircled{19} \frac{4(5-\sqrt{3})}{(5+\sqrt{3})(5-\sqrt{3})}$$

$$= \frac{20-4\sqrt{3}}{22}$$

$$= \frac{2(10-2\sqrt{3})}{22} = \frac{10-2\sqrt{3}}{11}$$

$$= \frac{20-4\sqrt{3}}{25-\cancel{5\sqrt{3}}+\cancel{5\sqrt{3}}-3}$$

$$\textcircled{20} \frac{(1-\sqrt{2})}{(3-\sqrt{5})} \cdot \frac{(3+\sqrt{5})}{(3+\sqrt{5})}$$

$$= \frac{3+\sqrt{5}-3\sqrt{2}-\sqrt{10}}{4}$$

$$\textcircled{21} \frac{6}{(2-\sqrt{7})} \cdot \frac{(2+\sqrt{7})}{(2+\sqrt{7})} = \frac{12+6\sqrt{7}}{-3} = \frac{3(4+2\sqrt{7})}{-3}$$

$$= \frac{-(4+2\sqrt{7})}{-4-2\sqrt{7}}$$

$$\textcircled{22} \quad \frac{48 - 8\sqrt{7} + 10\sqrt{6} - \sqrt{70}}{29}$$

54

$$\sqrt{4} = 2$$

$$\underline{2} \cdot \underline{2} = 4$$

$$\sqrt{9} = 3$$

$$3 \cdot 3 = 9$$

$$\sqrt{\underline{9}} = 3$$

Imaginary $\# = \sqrt{-1}$ symbol = i
 $i = \sqrt{-1}$

$$\text{Ex: } \sqrt{-5} = \sqrt{-1 \cdot 5} = \sqrt{-1} \sqrt{5} \\ \boxed{i\sqrt{5}}$$

$$\text{Ex: } \sqrt{-49} = \sqrt{-1 \cdot 49} = i\sqrt{49} = 7i$$

$$\text{Ex: } \sqrt{-12} = i\sqrt{12} = \boxed{2i\sqrt{3}}$$

$\swarrow \searrow$
 $4 \cdot 3$

$$i^1 = \sqrt{-1} \quad i^2 = \sqrt{-1} \cdot \sqrt{-1} = \textcircled{-1}$$

$$i^3 = \underbrace{\sqrt{-1} \cdot \sqrt{-1}}_{-1} \cdot \sqrt{-1}$$

-1 · i

-i

$$i^4 = \underbrace{\sqrt{-1} \cdot \sqrt{-1}}_{-1} \cdot \underbrace{\sqrt{-1} \cdot \sqrt{-1}}_{-1}$$

-1 · -1

1

Complex #'s

$$5 + 3i$$

↑
real

↑
imaginary

① $(3 + 4i) + (5 - 3i)$

$$\boxed{8 + i}$$

② $(2 + 3i) + (-4 + 2i)$

$$\boxed{-2 + 5i}$$

③ $(2 - 4i) + (+2 - 3i)$

$$\boxed{4 - 7i}$$

Practice

$$\textcircled{4} 9 + 4i$$

$$\textcircled{5} -9 + 18i$$

$$\textcircled{6} 5 - 20i$$

$$i = \sqrt{-1}$$

$$i^2 = -1$$

$$i^3 = -i$$

$$i^4 = 1$$

$$\textcircled{1} 5i(-2+i)$$

$$-10i + 5i^2$$

$$-10i + 5 \cdot -1$$

$$\boxed{-10i - 5}$$

$$\textcircled{2} (7-4i)(-1+2i)$$

$$-7 + 14i + 4i - 8i^2$$

$$-7 + 18i - 8i^2$$

$$\textcircled{-7} + 18i + \textcircled{8}$$

$$\boxed{1 + 18i}$$

$$(3) \quad (6+3i)(6-3i)$$

$$36 - 18i + 18i - 9i^2$$

$$36 - 9(\overset{= -1}{i^2})$$

$$36 + 9$$

$$\boxed{45}$$

$$\textcircled{4} \quad 6i(-10+3i)$$

$$-60i + 18i^2$$

$$\boxed{-60i - 18}$$

$$\textcircled{5} \quad (11-2i)(-5+7i)$$

$$-55 + 77i + 10i - 14i^2$$

$$-55 + 87i - 14i^2$$

$$-55 + 87i + 14$$

$$\boxed{-41 + 87i}$$

$$\textcircled{6} \quad (5+4i)(8-10i)$$

$$40 - 50i + 32i - 40i^2$$

$$40 - 18i + 40$$

$$\boxed{80 - 18i}$$